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# Tobacco Use, Secondhand Smoke, and Smoke-Free Home Rules in Multiunit Housing



Kimberly H. Nguyen, MS, MPH, Yessica Gomez, MPH, David M. Homa, PhD, Brian A. King, PhD, MPH

**Introduction:** Multiunit housing (MUH) residents are particularly susceptible to involuntary secondhand smoke (SHS) exposure in their home, which can enter their living units from nearby units and shared areas where smoking occurs. To date, no study has assessed non-cigarette tobacco use among MUH residents. This study assessed the prevalence and sociodemographic correlates of tobacco use (combustible, noncombustible, any tobacco use including electronic cigarettes), smoke-free home rules, and SHS incursions among U.S. MUH residents.

**Methods:** Data came from the 2013–2014 National Adult Tobacco Survey, a telephone survey of U.S. adults aged  $\geq 18$  years. Analyses were conducted in 2015. Prevalence of current tobacco use and smoke-free home rules were assessed overall and by sociodemographics, stratified by housing type (single family versus MUH). Prevalence and adjusted odds of SHS incursions among MUH residents with smoke-free home rules were assessed.

**Results:** Tobacco use was higher among adults living in MUH (24.7%) than those in single-family housing (18.9%,  $p < 0.05$ ). Smoke-free home rules were higher among adults living in single-family housing (86.7%) than those in MUH (80.9%,  $p < 0.05$ ). Among MUH residents with smoke-free homes, 34.4% experienced SHS incursions. Adjusted odds of SHS incursions were greater among women, younger adults, non-Hispanic blacks, Hispanics, and those with lower income.

**Conclusions:** One quarter of MUH residents use tobacco, and one third of MUH residents with smoke-free rules experience SHS incursions. Interventions are warranted to promote tobacco cessation and smoke-free building policies to protect all MUH residents, employees, and visitors from the dangers of tobacco use and SHS.

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## Introduction

Secondhand smoke (SHS) exposure has been causally linked to adverse health outcomes, including heart disease and lung cancer in adults, and increased risk of acute respiratory infections, ear problems, and sudden infant death syndrome in children.<sup>1–4</sup> The U.S. Surgeon General has concluded that there is no risk-free level of SHS exposure.<sup>1</sup> Nonetheless, during

2011–2012, approximately 58 million U.S. nonsmokers (25.3%), including 15 million children aged 3–11 years, were exposed to SHS.<sup>5</sup>

Over the past several decades, there have been substantial achievements in tobacco control.<sup>1</sup> However, though cigarette smoking has decreased, the use of other tobacco products, including combustible (e.g., cigars, cigarillos, and little cigars), noncombustible (e.g., chewing tobacco and snus), and emerging products (e.g., electronic nicotine delivery systems [ENDS], including electronic cigarettes [e-cigarettes]) has remained unchanged or increased.<sup>3,6</sup> This diversification of the tobacco product landscape presents new challenges to public health and makes it increasingly important to shape tobacco prevention and control efforts in the context of all forms of tobacco use.<sup>3</sup> For example, the aerosol from some ENDS products has been shown to

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contain nicotine and other harmful and potentially harmful substances.<sup>7–9</sup> Therefore, exposure to ENDS aerosol has the potential to involuntarily expose bystanders to aerosolized nicotine and other harmful substances.

Exposure to SHS has been successfully reduced in public settings through comprehensive smoke-free laws prohibiting smoking in all indoor areas of worksites and public places, including restaurants and bars.<sup>10–12</sup> However, these laws do not include private settings such as the home, which is a primary source of SHS exposure for children.<sup>1</sup> Smoke-free home rules can help reduce SHS exposure among nonsmokers, prevent smoking initiation among youth and adults, support tobacco cessation among current smokers, and reduce the social acceptability of smoking.<sup>1,13–15</sup> From 1992–1993 to 2010–2011, smoke-free home rule prevalence in U.S. households increased from 43.0% to 83.0%.<sup>16</sup> However, many U.S. households still lack smoke-free home rules, including 53.9% of households with at least one adult smoker.<sup>16</sup>

Residents of multiunit housing (MUH), as well as employees and visitors, are particularly susceptible to involuntary exposure to SHS in this environment, which can enter living units from nearby units and shared areas where smoking occurs.<sup>17–20</sup> SHS can transfer throughout MUH via walls, ductwork, windows, and ventilation systems, among other routes.<sup>17,18,20</sup> More than one quarter of the U.S. population, or 80 million individuals, reside in MUH, and a nationally representative survey found that among MUH residents with smoke-free home rules, an estimated 44% had experienced SHS incursions in their unit within the past year that originated from outside their unit.<sup>21</sup> This is compounded by the fact that certain types of MUH, including government-subsidized housing, are occupied by large proportions of vulnerable population groups that are already at higher risk for chronic disease and poor health outcomes, including those with low income, racial/ethnic minorities, children, the elderly, and the disabled.<sup>20,22</sup>

Previous research has assessed the extent of cigarette smoking, smoke-free home rules, and SHS exposure among U.S. MUH residents.<sup>17–21</sup> However, no study has assessed the extent of non-cigarette (tobacco use other than cigarette smoking) use among MUH residents. The assessment of non-cigarette tobacco products, particularly other combustible products and ENDS products, is becoming increasingly important, given the diversification of the tobacco product landscape in recent years.<sup>3</sup> To address these gaps, this study assessed the reported prevalence and sociodemographic correlates of tobacco use, smoke-free home rules, and SHS incursions among U.S. MUH residents; to assess reported variations by housing type, these estimates were compared with adults in single family homes.

## Methods

### Data Source

Data came from the 2013–2014 National Adult Tobacco Survey, a landline and cellular telephone survey of non-institutionalized U.S. adults aged  $\geq 18$  years.<sup>23</sup> The sample was drawn from households in the 50 U.S. states and District of Columbia. From October 2013 to October 2014, a total of 75,233 interviews were completed (landline, 52,594; cellular, 22,639); the response rate was 36.1% (landline, 47.6%; cellular, 17.1%). This analysis was exempt from IRB review because it was a secondary analysis of de-identified data.

### Measures

Tobacco use was categorized using four mutually exclusive categories:

1. combustible only;
2. noncombustible only;
3. both combustible and noncombustible; and
4. no current tobacco use.

Additionally, a fifth overall tobacco category (not mutually exclusive) was created to represent any tobacco use.

Current combustible use was defined as smoking  $\geq 100$  cigarettes, smoking cigars/cigarillos/filtered little cigars  $\geq 50$  times, smoking regular pipes once or more, or smoking water pipes/hookahs once or more during their lifetime, and now using these respective products “every day” or “some days.” Current noncombustible use was defined as using chewing tobacco, snuff, or dip  $\geq 20$  times, or snus or dissolvable tobacco products on  $\geq 1$  day during their lifetime, and now using these products “every day” or “some days.”

“Any tobacco use” was defined as current combustible use, noncombustible use, or e-cigarette use (use one or more time during lifetime and now use “every day” or “some days”). E-cigarettes were included in the “any tobacco use” category because in 2011, a Federal appeals court ruled that e-cigarettes and other products “made or derived from tobacco” are tobacco products unless they are marketed as drugs.<sup>24</sup> Accordingly, the U.S. Food and Drug Administration has promulgated a proposed rule that would bring e-cigarettes that do not make therapeutic claims under its tobacco authorities.<sup>25</sup> No current tobacco use was defined as not currently using combustible tobacco, noncombustible tobacco, or e-cigarettes.

Smoke-free home rules were determined by the question: *Not counting decks, porches, or garages, inside your home, is smoking “always allowed,” “allowed only at some times or in some places,” or “never allowed?”* Respondents who selected *never allowed* were classified as having a smoke-free home rule.

To assess the extent of involuntary exposure to SHS among MUH residents, SHS incursions were determined among adults who live in MUH and have a smoke-free home rules using the following question: *How often does tobacco smoke enter your living space from somewhere else in or around the building?* Adults who replied *every day, a few times a week, a few times a month, or once a month or less* were considered to have experienced an SHS incursion, whereas those who replied *never* were considered to have not experienced an SHS incursion. The analysis was restricted

to MUH residents with smoke-free home rules to assess the extent of involuntary SHS incursions in these units, irrespective of whether the respondent was a smoker or nonsmoker.

Housing type was determined using the following question: *In what type of living space do you currently reside?* Respondents who replied *one-family house detached from any other house* were categorized as living in single-family housing, whereas those who replied *one-family house attached to one or more houses or a building with two apartments or living units* were categorized as living in MUH. All other housing types, including mobile homes, boats, recreational vehicles, vans, or some other type of living space, were omitted from the analyses because they were not considered either MUH or single-family housing (7%).

Assessed sociodemographics included: sex, age, race/ethnicity, educational attainment, annual household income, marital status, sexual orientation, and U.S. Census region (Table 1).

## Statistical Analysis

All analyses were conducted in 2015. Descriptive statistics were calculated to assess the reported prevalence of current tobacco use and smoke-free home rules by tobacco group and housing type, both overall and by each sociodemographic characteristic. For each tobacco use category, pairwise comparisons were computed to assess for statistically significant ( $p < 0.05$ ) differences in proportions between single-family housing and MUH residents for each sociodemographic group.

Descriptive statistics and logistic regression were also conducted to determine the prevalence and correlates of SHS incursions among MUH residents with smoke-free home rules. All analyses were conducted using SAS-callable SUDAAN, version 11, and data were weighted to adjust for selection and nonresponse.

## Results

The percentage of adults who used tobacco products was higher in MUH than in single-family housing for any tobacco product use (24.7% vs 18.9%) and combustible-only product use (19.8% vs 13.6%,  $p < 0.05$ ; Table 1). However, non-combustible only use (1.9% vs 0.9%) and no tobacco use (81.1% vs 75.3%) were higher in single-family housing than MUH, respectively ( $p < 0.05$ ). Any tobacco use was higher among MUH residents than those in single-family housing for each sociodemographic characteristic ( $p < 0.05$ ; Table 1).

Within single-family housing, any tobacco use and combustible-only use were significantly associated with each of the assessed sociodemographic factors (sex, age, race/ethnicity, education, income, marital status, sexual orientation, and region;  $p < 0.05$ ). Specifically, the use of any tobacco products in single-family housing was highest among men; adults aged 18–24 years; non-Hispanic blacks; those with less than a high school education or income  $< \$20,000$ ; unmarried adults; lesbian, gay, or bisexual adults; and those living in the South ( $p < 0.05$ ).

Any tobacco use among MUH residents was significantly associated with each sociodemographic factor. Any tobacco product use and combustible-only use in MUH was highest among men; adults aged 45–64 years; non-Hispanic blacks; those with only a high school education or income  $< \$20,000$ ; unmarried adults; lesbian, gay, or bisexual adults; and those living in the Midwest ( $p < 0.05$ ).

The prevalence of smoke-free home rules was lower in MUH than single-family housing overall (80.9% vs 86.7%), and among users of any tobacco product (53.7% vs 62.5%) and combustible-only products (49.7% vs 58.0%), respectively ( $p < 0.05$ ; Table 2). Among any tobacco users, smoke-free home rule prevalence was higher in single-family housing than in MUH across selected subpopulations (i.e., men and women, adults aged  $\geq 25$  years, non-Hispanic whites, adults with at least a high school degree or income  $\geq \$50,000$ , adults of all marital statuses, heterosexuals, and adults living in all regions except the West;  $p < 0.05$ ).

Within single-family housing, smoke-free home rule prevalence was highest among women; adults aged 25–44 years; Hispanics; those with a college degree or income  $\geq \$100,000$ ; married or cohabitating adults; those who are heterosexual, straight, or have unspecified sexual orientation; and those living in the West ( $p < 0.05$ ). Among any tobacco users, smoke-free home rule prevalence was highest among men, adults aged 25–44 years, Hispanics, those with a college degree or income  $\geq \$100,000$ , married or cohabitating adults, those who are heterosexual/straight or have unspecified sexual orientation, and those living in the West ( $p < 0.05$ ).

Smoke-free home rules prevalence in MUH was highest among women, adults aged  $\geq 65$  years, Hispanics, those with a college degree or income  $\geq \$100,000$ , married or cohabitating adults, those who have not specified their sexual orientation, and those living in the West ( $p < 0.05$ ). Among any tobacco users, smoke-free home rule prevalence was highest for the same sociodemographic characteristics, with the exception of sex and age ( $p < 0.05$ ).

Among MUH residents with smoke-free home rules, 34.4% reported experiencing SHS incursions (Table 3; 7.8% reported exposure every day, 9.0% reported exposure a few times a week, 6.9% reported exposure a few times a month, and 10.8% reported exposure once a month or less [data not shown]). The prevalence of experiencing an SHS incursion was highest among women (36.0%,  $p < 0.05$ ); adults aged 25–44 years (38.1%,  $p < 0.05$ ); Hispanics (41.8%,  $p < 0.05$ ); adults with no high school degree (38.6%,  $p < 0.05$ ); those with annual household income  $< \$20,000$  (38.9%,  $p < 0.05$ ); lesbian, gay, or bisexual adults (37.2%,  $p < 0.05$ ); and those living in the West (39.6%,  $p < 0.05$ ).

**Table 1.** Prevalence of Current Tobacco Use, by Housing Type and Selected Sociodemographic Characteristics, National Adult Tobacco Survey, 2013–2014

Characteristic	Single-family housing, %					MUH, %				
	Any tobacco <sup>a</sup> (n=7,659)	Combustible only <sup>b</sup> (n=5,457)	Non-combustible only <sup>c</sup> (n=784)	Combustible and non-combustible <sup>d</sup> (n=197)	No tobacco <sup>e</sup> (n=43,814)	Any tobacco <sup>a</sup> (n=3,068)	Combustible only <sup>b</sup> (n=2,378)	Non-combustible only <sup>c</sup> (n=130)	Combustible and non-combustible <sup>d</sup> (n=73)	No tobacco <sup>e</sup> (n=11,818)
Overall	18.9	13.6	1.9	0.6	81.1	24.7 <sup>f</sup>	19.8 <sup>f</sup>	0.9 <sup>f</sup>	0.7	75.3 <sup>f</sup>
Sex										
Male	23.4 <sup>g</sup>	15.3 <sup>g</sup>	3.9	1.2	76.6 <sup>g</sup>	30.6 <sup>f,g</sup>	23.6 <sup>f,g</sup>	1.7 <sup>f</sup>	1.2	69.4 <sup>f</sup>
Female	14.5	12.0	— <sup>h</sup>	— <sup>h</sup>	85.5	19.3 <sup>f</sup>	16.5 <sup>f</sup>	— <sup>h</sup>	— <sup>h</sup>	80.7 <sup>f</sup>
Age (years)										
18–24	25.9 <sup>g</sup>	16.1 <sup>g</sup>	2.7 <sup>g</sup>	2.2	74.1 <sup>g</sup>	21.7 <sup>f,g</sup>	14.8 <sup>g</sup>	1.6 <sup>f</sup>	1.3	78.3 <sup>f,g</sup>
25–44	24.2	17.1	2.6	0.9	75.8	27.3 <sup>f</sup>	21.9 <sup>f</sup>	0.9 <sup>f</sup>	0.8	72.7 <sup>f</sup>
45–64	18.0	13.7	1.8	0.2	82.0	29.7 <sup>f</sup>	25.7 <sup>f</sup>	0.7 <sup>f</sup>	0.4	70.3 <sup>f</sup>
≥ 65	9.4	7.5	1.0	— <sup>h</sup>	90.6	11.5 <sup>f</sup>	9.8 <sup>f</sup>	0.4 <sup>f</sup>	— <sup>h</sup>	88.5 <sup>f</sup>
Race/ethnicity										
NH white	18.7 <sup>g</sup>	12.9 <sup>g</sup>	2.3	0.7	81.3 <sup>g</sup>	25.7 <sup>f,g</sup>	19.2 <sup>f,g</sup>	1.4 <sup>f</sup>	0.8	74.3 <sup>f,g</sup>
NH black	22.0	19.0	— <sup>h</sup>	— <sup>h</sup>	78.0	27.5 <sup>f</sup>	25.1 <sup>f</sup>	— <sup>h</sup>	— <sup>h</sup>	72.5 <sup>f</sup>
Hispanic	16.3	13.0	— <sup>h</sup>	— <sup>h</sup>	83.7	20.1 <sup>f</sup>	16.4 <sup>f</sup>	— <sup>h</sup>	— <sup>h</sup>	79.9 <sup>f</sup>
NH other	21.1	14.6	1.6	1.0	78.9	24.6	20.1 <sup>f</sup>	0.9	1.2	75.4 <sup>f</sup>
Education										
< High school	31.2 <sup>g</sup>	24.3 <sup>g</sup>	2.6 <sup>g</sup>	1.5 <sup>g</sup>	68.8 <sup>g</sup>	30.1 <sup>g</sup>	26.1 <sup>g</sup>	0.6 <sup>f</sup>	— <sup>h</sup>	69.9 <sup>g</sup>
High school	25.0	17.7	2.8	0.9	75.0	32.2 <sup>f</sup>	26.6 <sup>f</sup>	0.9 <sup>f</sup>	0.9	67.8 <sup>f</sup>
Some college	20.3	14.6	1.8	0.5	79.7	27.1 <sup>f</sup>	20.8 <sup>f</sup>	1.2 <sup>f</sup>	0.8	72.9 <sup>f</sup>
≥ College graduate	8.0	5.6	1.2	0.2	92.0	10.2 <sup>f</sup>	7.5 <sup>f</sup>	0.7 <sup>f</sup>	0.3	89.8 <sup>f</sup>
Household income										
< \$20,000	29.9 <sup>g</sup>	24.6 <sup>g</sup>	1.5	0.6 <sup>g</sup>	70.1 <sup>g</sup>	32.4 <sup>g</sup>	27.9 <sup>g</sup>	0.6 <sup>f</sup>	0.8	67.6 <sup>g</sup>
\$20,000–\$49,999	24.5	18.5	2.0	0.5	75.5	27.0 <sup>f</sup>	22.1 <sup>f</sup>	0.9 <sup>f</sup>	0.5	73.0 <sup>f</sup>
\$50,000–\$99,999	16.9	11.4	2.1	0.8	83.1	20.3 <sup>f</sup>	14.1 <sup>f</sup>	1.3 <sup>f</sup>	0.8	79.7
≥ \$100,000	11.4	7.1	2.1	0.2	88.6	14.9 <sup>f</sup>	10.8 <sup>f</sup>	0.7 <sup>f</sup>	0.5	85.1

(continued on next page)

**Table 1.** Prevalence of Current Tobacco Use, by Housing Type and Selected Sociodemographic Characteristics, National Adult Tobacco Survey, 2013–2014 (*continued*)

Characteristic	Single-family housing, %					MUH, %				
	Any tobacco <sup>a</sup> (n=7,659)	Combustible only <sup>b</sup> (n=5,457)	Non-combustible only <sup>c</sup> (n=784)	Combustible and non-combustible <sup>d</sup> (n=197)	No tobacco <sup>e</sup> (n=43,814)	Any tobacco <sup>a</sup> (n=3,068)	Combustible only <sup>b</sup> (n=2,378)	Non-combustible only <sup>c</sup> (n=130)	Combustible and non-combustible <sup>d</sup> (n=73)	No tobacco <sup>e</sup> (n=11,818)
Unspecified	20.3	15.2	1.7	0.7	79.7	24.4 <sup>f</sup>	20.3 <sup>f</sup>	0.8 <sup>f</sup>	0.7	75.6 <sup>f</sup>
Marital status										
Married/cohabitating	16.1 <sup>g</sup>	11.2 <sup>g</sup>	2.0	0.5 <sup>g</sup>	83.9 <sup>g</sup>	22.2 <sup>f,g</sup>	17.6 <sup>f,g</sup>	0.7 <sup>f</sup>	0.6	77.8 <sup>f,g</sup>
Not married <sup>i</sup>	24.5	18.4	1.9	0.9	75.5	26.6 <sup>f</sup>	21.5 <sup>f</sup>	1.0 <sup>f</sup>	0.7	73.4 <sup>f</sup>
Sexual orientation										
Heterosexual/straight	18.3 <sup>g</sup>	13.0 <sup>g</sup>	2.0	0.6	81.7 <sup>g</sup>	23.8 <sup>f,g</sup>	18.9 <sup>f,g</sup>	0.9 <sup>f</sup>	0.6	76.2 <sup>f,g</sup>
Lesbian/gay/bisexual	28.6	21.8	— <sup>h</sup>	— <sup>h</sup>	71.4	35.2 <sup>f</sup>	28.1 <sup>f</sup>	— <sup>h</sup>	— <sup>h</sup>	64.8 <sup>f</sup>
Unspecified	24.2	18.8	1.9	0.8	75.8	30.0 <sup>f</sup>	25.2 <sup>f</sup>	1.0 <sup>f</sup>	0.8	70.0 <sup>f</sup>
U.S. region <sup>j</sup>										
Northeast	15.0 <sup>g</sup>	11.5 <sup>g</sup>	1.3 <sup>g</sup>	0.4 <sup>g</sup>	85.0 <sup>g</sup>	22.8 <sup>f,g</sup>	19.2 <sup>f,g</sup>	0.7 <sup>f</sup>	0.7 <sup>g</sup>	77.2 <sup>f,g</sup>
Midwest	21.2	15.3	2.4	0.7	78.8	28.2 <sup>f</sup>	23.9 <sup>f</sup>	0.6 <sup>f</sup>	0.5	71.8 <sup>f</sup>
South	21.4	15.4	2.2	0.7	78.6	26.0 <sup>f</sup>	20.1 <sup>f</sup>	1.2 <sup>f</sup>	1.1	74.0 <sup>f</sup>
West	15.0	10.4	1.5	0.4	85.0	22.6 <sup>f</sup>	17.2 <sup>f</sup>	0.9 <sup>f</sup>	0.6	77.4 <sup>f</sup>

Note: Boldface indicates statistical significance ( $p < 0.05$ ) from tests of differences in proportions or chi squared tests. The specific significance test is indicated by footnotes f or g.

<sup>a</sup>Defined as “every day” or “some day” use of cigarettes, cigars/cigarillos/filtered little cigars, regular pipes, and water pipes/hookah, electronic cigarettes, or chewing tobacco/snuff/dip, snus, or dissolvable tobacco.

<sup>b</sup>Defined as smoking at least 100 cigarettes during their lifetime and now smoking “every day” or “some day” and/or used  $\geq 1$  of the following tobacco product types and now use “everyday” or “some days”: cigars/cigarillos/filtered little cigars, regular pipes, and water pipes/hookah  $\geq 50$  times in their lifetime and now smoked the product “every day” or “some days.”

<sup>c</sup>Defined as using chewing tobacco, snuff, or dip  $\geq 20$  times in their lifetime, snus or dissolvable tobacco products on  $\geq 1$  day, and used these products “every day” or “some days.”

<sup>d</sup>Defined as “every day” or “some day” use of any combustible tobacco product and any noncombustible tobacco product.

<sup>e</sup>Defined as not currently using combustible tobacco, noncombustible tobacco, or electronic cigarettes.

<sup>f</sup>Significant test of difference in proportions ( $p < 0.05$ ) between single-family housing and MUH for each tobacco use category.

<sup>g</sup>Significant chi-square test ( $p < 0.05$ ) indicated differences across sociodemographic subgroups (e.g., male vs female) within the specified tobacco use and housing category.

<sup>h</sup>Excluded because relative standard error  $\geq 30\%$ .

<sup>i</sup>Single/separated/divorced/widowed.

<sup>j</sup>Northeast: Connecticut, Maine, Massachusetts, New Jersey, New Hampshire, New York, Pennsylvania, Rhode Island, and Vermont; Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

MUH, multiunit housing; NH, non-Hispanic.



**Table 2.** Prevalence of Smoke-Free Homes Rules<sup>a</sup>, by Housing Type, Current Tobacco Use, and Selected Sociodemographic Characteristics, National Adult Tobacco Survey, 2013–2014

Characteristic	Single-family housing, %						MUH, %					
	Overall (n=44,257)	Any tobacco <sup>b</sup> (n=4,202)	Combustible only <sup>c</sup> (n=2,740)	Non-combustible only <sup>d</sup> (n=632)	Combustible and non-combustible <sup>e</sup> (n=117)	No tobacco <sup>f</sup> (n=29,40)	Overall (n=11,813)	Any tobacco <sup>b</sup> (n=1,390)	Combustible only <sup>c</sup> (n=979)	Non-combustible only <sup>d</sup> (n=99)	Combustible and non-combustible <sup>e</sup> (n=40)	No tobacco <sup>f</sup> (n=1,413)
Overall	86.7	62.5	58.0	86.9	65.6	92.0	80.9	53.7 <sup>g</sup>	49.7 <sup>g</sup>	83.9	68.0	89.2 <sup>g</sup>
Sex												
Male	85.8 <sup>h</sup>	66.1 <sup>h</sup>	60.1 <sup>h</sup>	86.8	66.1	91.5 <sup>h</sup>	79.4 <sup>h</sup>	57.9 <sup>g,h</sup>	53.3 <sup>g,h</sup>	84.1	63.7 <sup>h</sup>	88.4 <sup>g,h</sup>
Female	87.5	57.1	55.7	87.7	— <sup>i</sup>	92.5	82.2	47.3 <sup>g</sup>	44.8 <sup>g</sup>	77.7	92.0	89.9
Age (years)												
18–24	80.1 <sup>h</sup>	67.7 <sup>h</sup>	66.8 <sup>h</sup>	82.2 <sup>h</sup>	63.4	84.4 <sup>h</sup>	80.0 <sup>h</sup>	62.2 <sup>h</sup>	58.1 <sup>h</sup>	85.4 <sup>h</sup>	81.9	84.7 <sup>h</sup>
25–44	88.2	69.4	65.4	90.9	68.5	93.8	83.2	61.8 <sup>g</sup>	57.3 <sup>g</sup>	92.0	66.1	90.8 <sup>g</sup>
45–64	86.1	56.0	51.4	85.5	60.6	92.4	75.3	39.4 <sup>g</sup>	37.7 <sup>g</sup>	60.6 <sup>g</sup>	53.8	89.5 <sup>g</sup>
≥ 65	88.1	52.6	48.1	80.2	59.7	91.7	84.5	39.0 <sup>g</sup>	37.8 <sup>g</sup>	89.0	— <sup>i</sup>	90.1 <sup>g</sup>
Race/ethnicity												
NH white	87.1 <sup>h</sup>	63.4 <sup>h</sup>	58.4 <sup>h</sup>	87.3	66.5	92.4 <sup>h</sup>	80.8 <sup>h</sup>	52.3 <sup>g,h</sup>	46.5 <sup>g,h</sup>	88.5	67.3	90.2 <sup>g,h</sup>
NH black	79.5	47.9	45.0	82.1	— <sup>i</sup>	88.0	74.6	40.3	38.5	74.4	— <sup>i</sup>	86.6
Hispanic	89.6	73.0	71.4	88.8	95.5	92.6	86.1	66.8	65.4	— <sup>i</sup>	89.3	90.5
NH other	85.8	59.8	57.8	84.8	52.4	92.5	81.4	64.0	62.0	76.3	57.1	87.2 <sup>g</sup>
Education												
< High school	76.5 <sup>h</sup>	51.7 <sup>h</sup>	47.2 <sup>h</sup>	88.3 <sup>h</sup>	54.4	87.2 <sup>h</sup>	77.4 <sup>h</sup>	52.6 <sup>h</sup>	50.2 <sup>h</sup>	84.5	89.3 <sup>g</sup>	87.5 <sup>h</sup>
High school	82.2	60.2	55.6	81.3	64.3	89.3	75.6	49.5 <sup>g</sup>	46.1 <sup>g</sup>	85.1	56.3	87.4
Some college	87.0	65.6	61.3	89.7	74.8	92.2	80.7	56.4 <sup>g</sup>	50.5 <sup>g</sup>	83.6	78.4	89.2 <sup>g</sup>
≥ College graduate	93.3	73.8	69.8	92.8	79.2	95.0	88.5	61.9 <sup>g</sup>	60.1 <sup>g</sup>	82.3	46.6	91.4 <sup>g</sup>
Household income												
< \$20,000	71.4 <sup>h</sup>	39.4 <sup>h</sup>	38.6 <sup>h</sup>	61.6 <sup>h</sup>	40.6	84.7 <sup>h</sup>	71.7 <sup>h</sup>	40.0 <sup>h</sup>	35.7 <sup>h</sup>	82.7	61.3	86.7 <sup>h</sup>
\$20,000–\$49,999	81.7	56.8	52.4	83.7	62.9	89.7	78.4	53.9	50.2	80.5	78.7	87.3 <sup>g</sup>
\$50,000–\$99,999	88.6	68.6	63.4	88.7	70.3	92.6	85.3	61.4 <sup>g</sup>	56.6	89.1	61.5	91.1
≥ \$100,000	93.4	79.8	77.4	92.8	92.6	95.2	88.0	63.8 <sup>g</sup>	60.9 <sup>g</sup>	73.6	65.3	92.2 <sup>g</sup>
Unspecified	86.3	61.6	58.5	85.6	55.2	91.5	84.2	59.5	58.3	87.1	71.4	90.4

(continued on next page)

**Table 2.** Prevalence of Smoke-Free Homes Rules<sup>a</sup>, by Housing Type, Current Tobacco Use, and Selected Sociodemographic Characteristics, National Adult Tobacco Survey, 2013–2014 (*continued*)

Characteristic	Single-family housing, %						MUH, %					
	Overall (n=44,257)	Any tobacco <sup>b</sup> (n=4,202)	Combustible only <sup>c</sup> (n=2,740)	Non-combustible only <sup>d</sup> (n=632)	Combustible and non-combustible <sup>e</sup> (n=117)	No tobacco <sup>f</sup> (n=29,40)	Overall (n=11,813)	Any tobacco <sup>b</sup> (n=1,390)	Combustible only <sup>c</sup> (n=979)	Non-combustible only <sup>d</sup> (n=99)	Combustible and non-combustible <sup>e</sup> (n=40)	No tobacco <sup>f</sup> (n=1,413)
Marital status												
Married/cohabitating	<b>89.5<sup>h</sup></b>	<b>67.0<sup>h</sup></b>	<b>62.2<sup>h</sup></b>	88.8	<b>81.2<sup>h</sup></b>	<b>93.6<sup>h</sup></b>	<b>84.5<sup>h</sup></b>	<b>60.0<sup>g,h</sup></b>	<b>56.7<sup>h</sup></b>	93.3	77.2	<b>91.1<sup>g,h</sup></b>
Not married <sup>i</sup>	<b>81.0</b>	<b>56.6</b>	<b>52.8</b>	82.5	<b>48.8</b>	<b>88.5</b>	<b>78.0</b>	<b>49.8<sup>g</sup></b>	<b>45.5<sup>g</sup></b>	79.2	62.2	<b>87.7</b>
Sexual orientation												
Heterosexual/straight	<b>86.9<sup>h</sup></b>	<b>63.2<sup>h</sup></b>	<b>58.5</b>	87.3	<b>68.5</b>	<b>92.2<sup>h</sup></b>	<b>80.8<sup>h</sup></b>	<b>53.0<sup>g</sup></b>	<b>48.8<sup>g</sup></b>	85.6	<b>63.4<sup>h</sup></b>	<b>89.3<sup>g</sup></b>
Lesbian/gay/bisexual	<b>77.2</b>	<b>51.4</b>	<b>51.0</b>	<b>85.0</b>	— <sup>j</sup>	<b>87.5</b>	<b>74.3</b>	53.0	46.8	— <sup>j</sup>	<b>97.2<sup>g</sup></b>	84.9
Unspecified	<b>86.9</b>	<b>55.4</b>	<b>51.4</b>	77.5	— <sup>j</sup>	<b>92.4</b>	<b>82.6</b>	60.6	61.8	— <sup>j</sup>	<b>88.4</b>	88.5
U.S. region <sup>k</sup>												
Northeast	<b>88.2<sup>h</sup></b>	<b>61.7<sup>h</sup></b>	<b>58.0<sup>h</sup></b>	87.3	<b>41.1</b>	<b>92.6<sup>h</sup></b>	<b>80.0<sup>h</sup></b>	<b>47.8<sup>g,h</sup></b>	<b>42.7<sup>g,h</sup></b>	82.2	62.5	<b>88.9<sup>g,h</sup></b>
Midwest	<b>83.9</b>	<b>56.2</b>	<b>51.1</b>	81.8	<b>76.6</b>	<b>91.0</b>	<b>74.7</b>	<b>41.7<sup>g</sup></b>	<b>38.9<sup>g</sup></b>	<b>97.8<sup>g</sup></b>	58.4	<b>87.3<sup>g</sup></b>
South	<b>85.4</b>	<b>62.1</b>	<b>57.8</b>	88.1	<b>60.4</b>	<b>91.4</b>	<b>80.6</b>	<b>54.4<sup>g</sup></b>	<b>50.1<sup>g</sup></b>	81.5	73.0	<b>89.2<sup>g</sup></b>
West	<b>90.5</b>	<b>72.7</b>	<b>68.6</b>	92.9	<b>77.1</b>	<b>93.6</b>	<b>86.6</b>	<b>70.8</b>	<b>69.9</b>	82.1	67.9	<b>90.9<sup>g</sup></b>

Note: Boldface indicates statistical significance ( $p < 0.05$ ) from tests of differences in proportions or chi squared tests. The specific significance test is indicated by footnotes g or h.

<sup>a</sup>Defined as a response of “never allowed” to the following question: “Not counting decks, porches, or garages, inside your home, is smoking “always allowed”; “allowed only at some times or in some places”; or “never allowed”?”.

<sup>b</sup>Defined as “every day” or “some day” use of cigarettes, cigars/cigarillos/filtered little cigars, regular pipes, and water pipes/hookah, electronic cigarettes, or chewing tobacco/snuff/dip, snus, or dissolvable tobacco.

<sup>c</sup>Defined as smoking at least 100 cigarettes during their lifetime and now smoking “every day” or “some day” and/or used  $\geq 1$  of the following tobacco product types and now use “everyday” or “some days”: cigars/cigarillos/filtered little cigars, regular pipes, and water pipes/hookah  $\geq 50$  times in their lifetime and now smoked the product “every day” or “some days.”

<sup>d</sup>Defined as using chewing tobacco, snuff, or dip  $\geq 20$  times in their lifetime; snus or dissolvable tobacco products on  $\geq 1$  day; and used these products “every day” or “some days.”

<sup>e</sup>Defined as “every day” or “some day” use of any combustible tobacco product and any noncombustible tobacco product.

<sup>f</sup>Defined as not currently using combustible tobacco, noncombustible tobacco, or electronic cigarettes.

<sup>g</sup>Significant test of difference in proportions ( $p < 0.05$ ) between single-family housing and MUH for each tobacco use category.

<sup>h</sup>Significant chi-square test ( $p < 0.05$ ) indicated differences across sociodemographic subgroups (e.g., male vs female) within the specified tobacco use and housing category.

<sup>i</sup>Excluded because relative standard error  $\geq 30\%$ .

<sup>j</sup>Single/separated/divorced/widowed.

<sup>k</sup>Northeast: Connecticut, Maine, Massachusetts, New Jersey, New Hampshire, New York, Pennsylvania, Rhode Island, and Vermont; Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

MUH, multiunit housing; NH, non-Hispanic.



**Table 3.** Prevalence and Adjusted Odds of SHS Incursions<sup>a</sup> in the Home Among MUH Residents with Smoke-Free Home Rules,<sup>b</sup> National Adult Tobacco Survey, 2013–2014

Characteristic	%	AOR (95% CI)
Overall	34.4	—
Sex		
Male	32.6	1.00
Female	36.0	<b>1.20 (1.06, 1.36)</b>
Age (years)		
18–24	36.4	1.00
25–44	38.1	1.06 (0.88, 1.28)
45–64	33.7	0.87 (0.71, 1.05)
≥ 65	21.5	<b>0.49 (0.40, 0.60)</b>
Race/Ethnicity		
Non-Hispanic white	29.8	1.00
Non-Hispanic black	37.4	<b>1.37 (1.16, 1.62)</b>
Hispanic	41.8	<b>1.32 (1.10, 1.60)</b>
Non-Hispanic other	36.6	1.17 (0.95, 1.45)
Education		
< High school	38.6	1.00
High school	34.9	0.96 (0.75, 1.23)
Some college	35.0	0.96 (0.75, 1.22)
≥ College graduate	31.4	0.88 (0.69, 1.12)
Household income		
< \$20,000	38.9	1.00
\$20,000–\$49,999	36.0	0.89 (0.73, 1.08)
\$50,000–\$99,999	33.5	0.83 (0.67, 1.02)
≥ \$100,000	28.5	<b>0.70 (0.55, 0.91)</b>
Unspecified	32.6	<b>0.76 (0.60, 0.95)</b>
Marital status		
Married/cohabitating	34.7	1.00
Not married <sup>c</sup>	34.2	1.00 (0.88, 1.14)
Sexual orientation		
Heterosexual/straight	34.0	1.00
Lesbian/gay/bisexual	37.2	1.07 (0.81, 1.42)
Unspecified	27.5	0.74 (0.51, 1.09)
U.S. region <sup>d</sup>		
Northeast	35.8	1.00
Midwest	30.7	<b>0.79 (0.67, 0.96)</b>

(continued)

**Table 3.** (continued)

Characteristic	%	AOR (95% CI)
South	30.7	<b>0.73 (0.62, 0.86)</b>
West	39.6	1.08 (0.91, 1.27)

Note: Boldface indicates statistically significant ORs ( $p < 0.05$ ).

<sup>a</sup>Defined as a response of “every day,” “a few times a week,” “a few times a month,” “once a month or less” to the question, “How often does tobacco smoke enter your living space from somewhere else in or around the building?” Response to this question was only assessed among MUH residents with a smoke-free home rule.

<sup>b</sup>Defined as a response of “never allowed” to the following question, “Not counting decks, porches, or garages, inside your home, is smoking “always allowed,” “allowed only at some times or in some places,” or “never allowed?””

<sup>c</sup>Single/separated/divorced/widowed.

<sup>d</sup>Northeast: Connecticut, Maine, Massachusetts, New Jersey, New Hampshire, New York, Pennsylvania, Rhode Island, and Vermont; Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

MUH, multiunit housing; SHS, secondhand smoke.

Following adjustment, the odds of an SHS incursion among MUH residents with smoke-free home rules was higher among women (OR=1.2, 95% CI=1.06, 1.36) versus men, and non-Hispanic blacks (OR=1.37, 95% CI=1.16, 1.62) and Hispanics (OR=1.32, 95% CI=1.10, 1.60) versus non-Hispanic whites ( $p < 0.05$ ). By contrast, the odds of experiencing SHS incursions was lower among adults aged ≥ 65 years (OR=0.49, 95% CI=0.40, 0.60) versus adults aged 18–24 years, those with annual household income ≥ \$100,000 (OR=0.70, 95% CI=0.55, 0.91) or unspecified income (OR=0.76, 95% CI=0.60, 0.95) versus those with annual household income < \$20,000, and those living in the Midwest (OR=0.79, 95% CI=0.67, 0.96) or South (OR=0.73, 95% CI=0.62, 0.86) versus those in the Northeast ( $p < 0.05$ ).

## Discussion

This study reveals that U.S. MUH residents have a greater prevalence of tobacco use, particularly combustible tobacco use, and lower prevalence of smoke-free home rules than single-family home residents, especially among combustible tobacco users. Additionally, about one third of MUH residents who have adopted smoke-free home rules have recently experienced SHS incursions in their home that originated from nearby living units or shared areas, with variations apparent across

population groups. This finding is consistent with studies from the general population of adults, which indicate that SHS exposure remains prevalent in the U.S. and that disparities in exposure persist.<sup>5</sup> Taken together, these findings underscore the importance of efforts to promote tobacco cessation and the adoption of smoke-free building policies in all MUH to protect the public from the harmful effects of tobacco use and exposure to SHS and secondhand e-cigarette aerosol. Given the evolving tobacco product landscape, it is important for such strategies to consider the diversity of tobacco products being used by MUH residents, including combustible, noncombustible, and electronic products.

Although previous research has reported higher cigarette smoking among MUH residents compared to single-family home residents,<sup>21</sup> this is the first national study to document higher prevalence of any tobacco use and combustible tobacco use among MUH residents. This study is also the first to document that smoke-free home rule adoption is lower among MUH residents than single-family home residents. However, consistent with the literature, disparities in smoke-free home rules were observed by tobacco use, race/ethnicity, education, and income.<sup>26–28</sup> The higher prevalence of combustible tobacco use, coupled with lower prevalence of smoke-free home rules among smokers who live in MUH, likely contributed to the finding that one third of MUH residents experience SHS incursions. These findings highlight the importance of implementing 100% smoke-free building policies in MUH to protect all occupants, employees, and visitors from the adverse effects of SHS exposure, including those residents who have implemented voluntary smoke-free home rules, but are still exposed to SHS from their neighbors who have not implemented such policies. Furthermore, to address the high burden of all forms of tobacco use observed among MUH residents, it is critical that such policies be implemented in coordination with efforts to promote tobacco cessation and encourage tobacco-free norms, including the provision of evidence-based tobacco-cessation services through healthcare providers and other population-based resources, such as quitlines.<sup>3</sup>

Studies have found that smoke-free building policies are favored by most MUH residents<sup>21,27,28</sup>; could result in significant cost savings for MUH owners and managers<sup>29</sup>; and are legally permissible in subsidized, public, and market-rate housing. Additionally, the U.S. Department of Housing and Urban Development has encouraged public housing authorities, and owners and managers of multifamily housing rental assistance programs, such as Section 8, to implement smoke-free policies in their properties.<sup>30</sup> Moreover, on November 12, 2015, the U.S. Department of Housing and Urban

Development proposed a policy for U.S. public housing, that if implemented as proposed, would prohibit “lit” tobacco products (cigarettes, cigars, or pipes) in all living units, indoor common areas, administrative offices, and all outdoor areas within 25 feet of housing and administrative office buildings.<sup>31</sup> As of October 2015, several hundred public housing authorities across the U.S. had instituted such policies, including all 20 in Maine.<sup>32</sup> Additionally, at least 12 communities in California have enacted laws that prohibit smoking in all private units in market-rate MUH and do not permit “grandfather” clauses that allow current residents to continue smoking in the prohibited areas.<sup>32</sup> A growing number of owners and managers of MUH have also voluntarily implemented such policies on their properties.<sup>32,33</sup>

However, despite existing evidence of the legal permissibility of smoke-free MUH buildings policies, strong support among residents, considerable cost savings, and strong momentum to implement such policies in both government subsidized and private market rate housing, prevalence of such policies remains low.<sup>21,28,29</sup> This may be due to misperceptions about barriers to implementing such policies, including concerns about increased vacancy, turnover, and enforcement problems among MUH owners and managers.<sup>34,35</sup> Concerns have also been raised that smoke-free MUH building policies could amplify sociodemographic disparities by adversely affecting low-income people and other vulnerable populations, which often have the highest prevalence of tobacco use, by displacing residents who do not comply.<sup>36</sup> However, these policies have strong potential to considerably reduce health disparities and the associated costs of SHS exposure.<sup>29,37,38</sup> Prohibiting smoking in public housing would yield an annual cost savings of \$153 million, including \$94 million in SHS-related health care, \$43 million in renovation of smoking-permitted units, and \$16 million in smoking-related fire losses.<sup>29</sup> This knowledge gap underscores the importance of educating MUH owners and managers about the health and economic benefits of prohibiting smoking on their properties, including disseminating information on the experiences of their peers who have already implemented such policies.<sup>29,37,38</sup>

## Limitations

This study is subject to some limitations. First, the National Adult Tobacco Survey is a cross-sectional survey, which could introduce recall bias. Second, the study did not account for other variables of potential interest that could contribute to smoke-free home rule adoption and the extent of SHS incursions, including whether the respondent lived in an MUH structure with

an existing smoke-free building policy. Third, MUH is available in various different forms (e.g., condos, townhouses, apartments) and subsidies (e.g., public housing, market rate), which were not accounted for in this study; estimates could vary by housing type and subsidy status. Fourth, the study only assessed SHS and not exposure to secondhand aerosol; emerging evidence indicates that ENDS aerosol can contain harmful and potentially harmful substances.<sup>7,8</sup> Finally, limited sample size prevented the presentation of estimates for certain groups.

## Conclusions

Completely eliminating smoking in indoor spaces is the only way to fully protect nonsmokers from SHS; separating smokers from nonsmokers, cleaning the air, and ventilating buildings do not completely eliminate SHS exposure.<sup>1</sup> Accordingly, interventions are warranted to promote tobacco use cessation and smoke-free building policies in MUH to reduce tobacco use and protect all residents, employees, and visitors from SHS exposure. Continued efforts to implement smoke-free building policies in all MUH, along with comprehensive smoke-free laws to eliminate SHS exposure in indoor public areas and workplaces, are critical to protect against this known and preventable health hazard.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

KN conceptualized the paper and conducted the analyses. All authors contributed to the interpretation of the results and the writing of the paper.

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